



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification: H04L 12/56, H04L 12/46, H04L 12/66, H04Q 11/04		A1	(11) International Publication Number: WO 00/62489
			(43) International Publication Date: 19 October 2000 (19.10.2000)
(21) International Application Number: PCT/FI00/00324			
(22) International Filing Date: 14 April 2000 (14.04.2000)		Published	
(30) Priority Data: 990827 14 April 1999 (14.04.1999) FI			
(60) Parent Application or Grant TELEFONAKTIEBOLAGET LM ERICSSON (publ) [/]; (). TURTAINEN, Esa [/]; (). TURTAINEN, Esa [/]; (). BORENIUS & CO OY AB ; ()			
<p>(54) Title: ROUTING BETWEEN COMMUNICATION NETWORKS (54) Titre: ACHEMINEMENT ENTRE RESEAUX DE COMMUNICATION</p> <p>(57) Abstract</p> <p>The present invention relates to a method of routing a call between a circuit switched network and a packet switched network in a network system comprising a media gateway between the circuit switched network and the packet switched network. In the method all routing procedures for the call are handled by a separate routing controller common for several media gateways. The invention relates further to an arrangement for performing the same.</p> <p>(57) Abrégé</p> <p>Cette invention a trait à une méthode d'acheminement d'un appel entre un réseau à commutation de circuit et un réseau à commutation de paquets dans un système en réseau comprenant une passerelle pour supports entre le réseau à commutation de circuit et le réseau à commutation de paquets. Dans le cadre de cette méthode, toutes les modalités d'acheminement de l'appel sont prises en charge par une unité de commande d'acheminement commune à plusieurs passerelles pour supports. L'invention porte également sur un dispositif permettant la mise en oeuvre de cette méthode.</p>			

PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

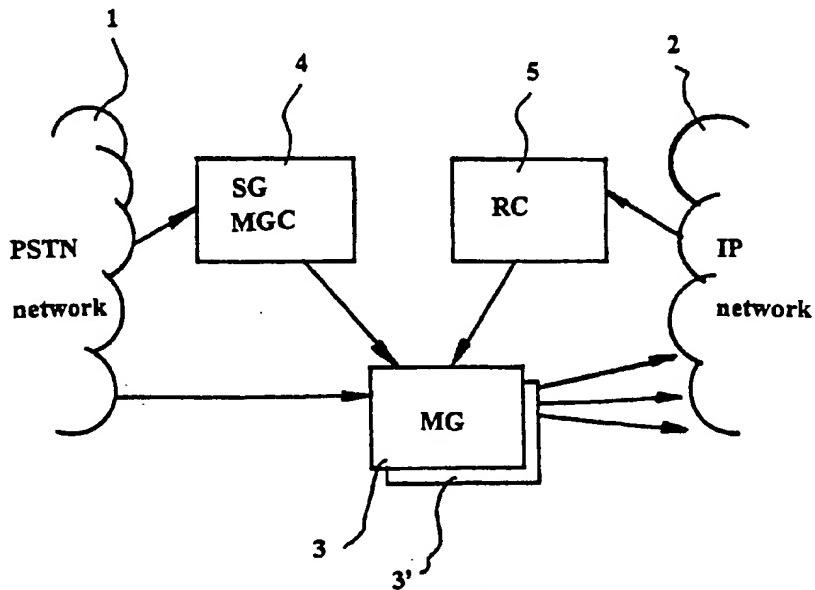


INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁷ : H04L 12/56, 12/66, 12/46, H04Q 11/04	A1	(11) International Publication Number: WO 00/62489
		(43) International Publication Date: 19 October 2000 (19.10.00)

(21) International Application Number: PCT/FI00/00324	(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).
(22) International Filing Date: 14 April 2000 (14.04.00)	
(30) Priority Data: 990827 14 April 1999 (14.04.99) FI	
(71) Applicant (<i>for all designated States except US</i>): TELEFON- AKTIEBOLAGET LM ERICSSON (publ) [SE/SE]; S-126 25 Stockholm (SE).	
(72) Inventor; and	Published
(75) Inventor/Applicant (<i>for US only</i>): TURTIAINEN, Esa [FI/FI]; Kartanonkuja 8 H, FIN-02360 Espoo (FI).	With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.
(74) Agent: BORENTIUS & CO OY AB; Kansakoulukuja 3, FIN-00100 Helsinki (FI).	

(54) Title: ROUTING BETWEEN COMMUNICATION NETWORKS



(57) Abstract

The present invention relates to a method of routing a call between a circuit switched network and a packet switched network in a network system comprising a media gateway between the circuit switched network and the packet switched network. In the method all routing procedures for the call are handled by a separate routing controller common for several media gateways. The invention relates further to an arrangement for performing the same.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IR	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakhstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

5

ROUTING BETWEEN COMMUNICATION NETWORKS

10

FIELD OF THE INVENTION

15

The present invention relates to a method of routing in telecommunication networks, and more precisely to a method of routing between a telephone network and a data network. The invention relates further to an arrangement for performing the routing operations between two different networks.

20

BACKGROUND OF THE INVENTION

25

An interfacing gateway or access node is required in the communication path or route between two different communication networks. For instance, an interfacing access node is required in cases where the other network is a telephone network, such as a Public Switched Telephone Network (PSTN) and the other network is a data network, such as a packet switched data network (PSDN). Examples of the packet switched networks include the global connectionless Internet utilising TCP/IP (Transport Control Protocol/Internet Protocol) protocol suite and various Intranet applications.

30

35

One possibility to implement the access node AN between the PSTN and the packet switched data network is a routing device referred to as Network Access Server (NAS). NAS can be defined as a device which receives calls from the PSTN and translates the calls into Internet IP packet form.

40

At least some degree of routing functionality is required in the communication network system for the transmission of the data packets over the data network in order to be able to

55

sent the data packets to a correct next router and finally to a correct destination address. This functionality is usually integrated to the NAS, or then all traffic goes through a separate router especially and solely arranged to accomplish the routing tasks. Routing protocols based on international agreements are used in order to be able to provide this functionality. The routing protocols are used to adapt dynamically to the variations in networks structures and also to the possible failures occurring during various stages of transmission of the data packets.

SUMMARY OF THE INVENTION

In case separate routers are used the routing causes one
25 extra step, and every packet has to be handled still once in
the NAS. This may cause delays in the traffic and increases
40 the risk for failures.

5

dynamically to form a modem or a voice over IP codec. This simplifies the structure of the MG (i.e. the access node for media) a lot, but does not solve the routing problem.

10

5 It is an object of the present invention to overcome the disadvantages of the prior art solutions and to provide a new type of solution for routing calls between different networks.

15

10 Another object of the present invention is to provide a method and arrangement by means of which the structure of the access node can be made less complex and unnecessary double processing of the data packets can be avoided.

20

25 According to a first aspect, the objects are obtained by a method of routing a call between a circuit switched network and a packet switched network in a network system comprising a media gateway between the circuit switched network and the packet switched network, wherein routing procedures for the 30 call are handled by a separate routing controller common for several media gateways.

35

35 The routing controller can give routing information to an appropriate media gateway concerning the destination of the 40 call traffic. The routing information may comprise the IP interface to be used and the IP address of the next router in the packet switched network. The routing controller for the packet switched network and signalling controller for the circuit switched network may also form a symmetric 45 structure relative to the media gateway. The call can originate both from the circuit switched network side and the packet switched network side.

40

50 According to another aspect the invention provides an 55 arrangement in a communication network system comprising: a

55

5 circuit switched network; a packet switched network; a plurality of media gateways between the networks; a signalling controller for handling circuit switched traffic; and a separate routing controller for handling packet
10 5 switched traffic routing, said separate routing controller being common to said plurality of media gateways.

15 The routing controller and the signalling controller can form a symmetric structure relative to the media gateway.
10 The plurality of media gateways can also be arranged in a stack.
20

25 According to a further aspect the invention provides a routing controller for a communication network system comprising a circuit switched network, a packet switched network, a plurality of media gateways between the networks, and a signalling controller for handling circuit switched traffic, wherein the routing controller is arranged to form
30 a separate routing controller for handling packet switched traffic routing such that said separate routing controller is common to said plurality of media gateways.
20

35 Several advantages are obtained by means of the present invention, since the solution provides a simplified
40 structure for the media gateway between different communications networks. Since the required media gateway apparatus is less complex than in the prior art solutions, it is thus economically more advantageous and also more reliable in use and less vulnerable for hardware and/or
45 software failures. The proposed solution does not have any disadvantageous effects in the performance or functionality of the system since the traffic is separated to different outgoing interfaces. The proposed system adapts well to any dynamic changes in the network system. In addition, by means
50 35 of the invention it becomes more easy to stack media gateway

5

units to a tight space.

10 In the following the present invention and the other objects
and advantages thereof will be described in an exemplifying
5 manner with reference to the annexed drawings, in which
similar reference characters throughout the various figures
refer to similar features.

15

BRIEF DESCRIPTION OF THE DRAWINGS

10 Figure 1 is a schematic presentation of network system
including a telephone network and a data network and linking
apparatus there between; and

20 25 Figure 2 discloses signalling flow according to one
embodiment of the present invention.

DETAILED DESCRIPTION OF THE DRAWINGS

30 20 Figure 1 is a schematical presentation of one network system
including a PSTN 1, IP network 2 (e.g. the TCP/IP Internet
or an intranet application) and an access node or a gateway
35 apparatus therebetween. The arrows indicate the signalling
directions in situation where a call has been initiated by a
terminal of the PSTN (not shown). In this example the
25 gateway apparatus comprises a plurality of media gateways 3,
3', a signalling gateway SG (for SS7 to ISUP over IP
conversion) and media gateway controller MGC handling call
40 related control 4.

45 30 Each MG 3,3' may contain only one generic DSP (Digital
Signal Processor) which can be programmed dynamically to
form a modem or a voice over IP codec. Thus the structure of
the MG can be made substantially simple, which reduces
50 35 remarkably the costs of the MG and also increases the
reliability of the MG. As disclosed, the MGs can be stacked

5 in a substantially tight space in a manner similar to
10 ordinary telephone exchanges. It is noted that even though
 figure 1 discloses only two MGs, the number of them could be
 substantially higher.

15 The gateway apparatus is further provided with a separate
 routing controller RC 5, the arrangement being such that the
 routing is separated similarly to the signalling gateway and
 media gateway controller 4 to the routing controller 5. In
 10 other words, the system is "symmetric" relative to the MGs in
 view of the PSTN and the IP network. Thus the former access
 servers are now simplified to form only media gateway units
 3,3'.

25 15 In a manner similar to the SG+MGC unit 4, the routing
 controller unit 5 is common for several media gateway units
 3,3'. The routing controller 5 is arranged to communicate to
 the IP network 2 by using appropriate routing protocols,
 such as the OSPF and the BGP, and to give required routing
 30 orders to the particular media gateway unit 3 or 3'. The
 main information required by the particular media gateway is
 the current situation concerning the destination of the
 traffic originating in the PSTN side and coming via a
 certain PSTN line. The required information typically
 35 consists of indication of correct IP interface which should
 be used and the IP address of the next router (i.e. the next
 40 "hop" in the data network).

45 An example of the routing protocols is the OSPF routing
 30 protocol (RFC2178) which is one of the IP protocols, more
 precisely IP protocol number 89. All those IP packets that
 are coming to the media gateway MG and are of protocol 89
 50 are tunnelled to the routing controller RC. The routing
 controller 5 sees all MG interfaces as its own interfaces,
 35 and when something is sent to a RC interface, it is

5

tunnelled to the MG and sent there. There are 5 types of OSPF packets and they all must fit in to an IP packet of size of 576 bytes (in case operated according to RFC2178 appendix A). Another typical protocol is RIP (RFC1723) that is a UDP based protocol (a transport level datagram layer above the IP layer, port 520). A similar tunnelling approach works in this as well when the traffic from UDP port 520 is forwarded to the routing controller.

10

The media gateway MG unit can be made as simple as possible by removing both IP routing handling and call control from it. This does not affect negatively to the performance or the functionality of the system because the traffic is separated to different outgoing ("egress") interfaces in a manner similar to a router. The system also adapts to any dynamic changes in the network in a manner similar to a router.

15

20

The PSTN users often have a dynamically assigned IP address. In this case the RC must "advertise" (i.e. announce) these addresses so that the other routers of the system are enabled to transmit the data packets to a correct MG.

35

It is also possible for an PSTN user to have a known IP network address or a subnet of an IP network. In this case the RC can call back to the PSTN telephone number associated with this IP address when somebody tries to reach said IP address from the IP network side. In case the connection has already been setup, this case will be like the one already discussed above.

40

The RC advertises routes to the fixed network addresses even in instances where the connections are down i.e. disconnected. The RC can accomplish this by using one, some or available ports based on local policy (for instance, some

50

55

5

MGs may be closer to the destination in the PSTN). When a packet addressed to a predefined destination arrives, the MG routes it to a special dynamic interface that makes the SG to set-up the requested telephone call. This may involve utilisation of one additional server, e.g. an AAA server (Authentication, Authorisation and Accounting server; most often used protocol for an AAA server being RADIUS) that maintains customer information in a database which is common for the SC and the RC.

10

15

10

Figure 2 discloses signalling flows 11 to 13 (numbers in circles) for the above described solution. At flow step 11 the AAA server 7 defines fixed routes and the RC 5 controls that the MG 3 becomes advertised of the addresses and sets up the MG 3 to start a connection should a data packet arrive. In flow step 12 a data packet arrives, whereafter the MG 3 contacts SG/MGC 4 in order to establish a connection. SG 4 ask for a telephone number from the AAA server 7 and establishes the connection to that number. Then the MG 3 forwards the data packet to the established connection 13. In case the same route is advertised in many MGs, it must in most cases be ensured that only one connection is established at the same time. However, there may be instances where it could be desirable to establish several connections, e.g. such that the user can receive several calls at the same time and/or that the bandwidth is increased by this and/or that the call may go to many geographical locations at the same time.

25

30

35

40

45

50

Thus the invention provides an apparatus and a method by which a significant improvement can be achieved in the area of routing between different networks. It should be noted that the foregoing exemplifying embodiments of the invention are not intended to restrict the scope of the invention to the specific forms presented above but the present invention

55

5

is meant rather to cover all modifications, similarities and alternatives which are included in the spirit and scope of the present invention, as defined by the appended claims.

10

15

20

25

30

35

40

45

50

55

5

Claims

- 10 1. A method of routing a call between a circuit switched network and a packet switched network in a network system comprising a media gateway between the circuit switched network and the packet switched network, wherein routing procedures for the call are handled by a separate routing controller common for several media gateways.
- 15 2. A method in accordance with claim 1, wherein the routing controller gives routing information to an appropriate media gateway concerning the destination of the call traffic.
- 20 3. A method in accordance with claim 2, wherein the routing information comprises the IP interface to be used and the IP address of the next router in the packet switched network.
- 25 4. A method in accordance with any of the preceding claims, wherein the routing controller for the packet switched network and signalling controller for the circuit switched network form a symmetric structure relative to the media gateway.
- 30 5. A method in accordance with any of the preceding claims, wherein the call comes to the media gateway from the circuit switched network side.
- 35 6. A method in accordance with any of claims 1 to 4, wherein the call comes to the media gateway from the packet switched network side and is destined to a terminal connected to the circuit switched network.
- 40 7. A method in accordance with claim 6, wherein, in case the terminal has a dynamically assigned IP address, the IP

5

address of the terminal is advertised by the routing controller to routers of the system.

10

5 8. A method in accordance with claim 6, wherein, in case the terminal has a known IP address, the routing controller calls back to a called circuit switched terminal number associated with said IP address.

15

10 9. An arrangement in a communication network system comprising:

20

a circuit switched network;
a packet switched network;
a plurality of media gateways between the networks;
a signalling controller for handling circuit switched traffic; and
a separate routing controller for handling packet switched traffic routing, said separate routing controller being common to said plurality of media gateways.

30

20 10. An arrangement in accordance with claim 9, wherein the routing controller and the signalling controller form a symmetric structure relative to the media gateway.

35

25 11. An arrangement in accordance with claim 9 or 10, wherein the plurality of media gateways is arranged in a stack.

40

30 12. A routing controller for a communication network system comprising a circuit switched network, a packet switched network, a plurality of media gateways between the networks, and a signalling controller for handling circuit switched traffic, wherein the routing controller is arranged to form a separate routing controller for handling packet switched traffic routing such that said separate routing controller is common to said plurality of media gateways.

50

55

1 / 1

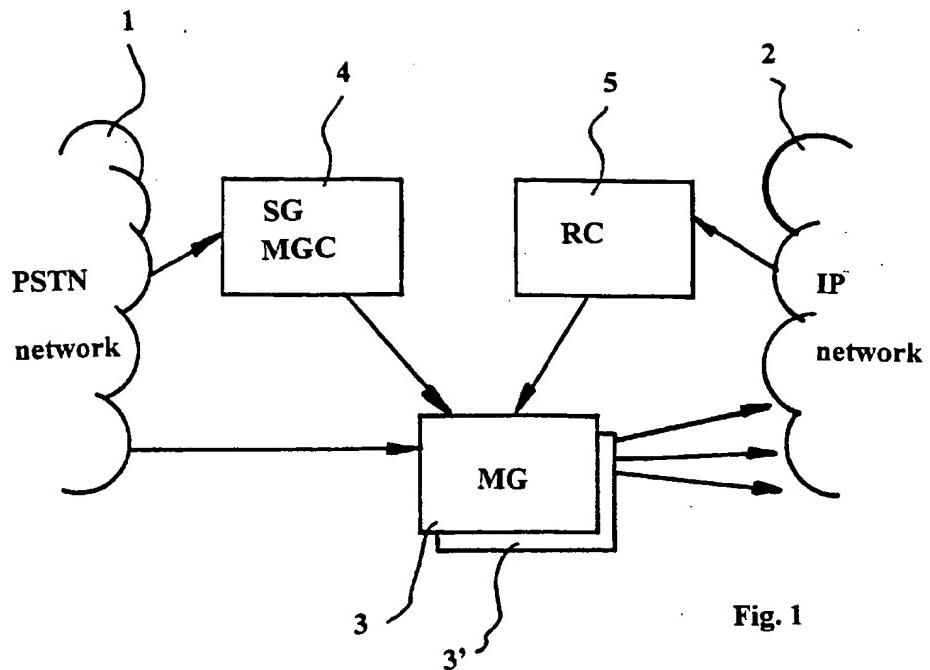


Fig. 1

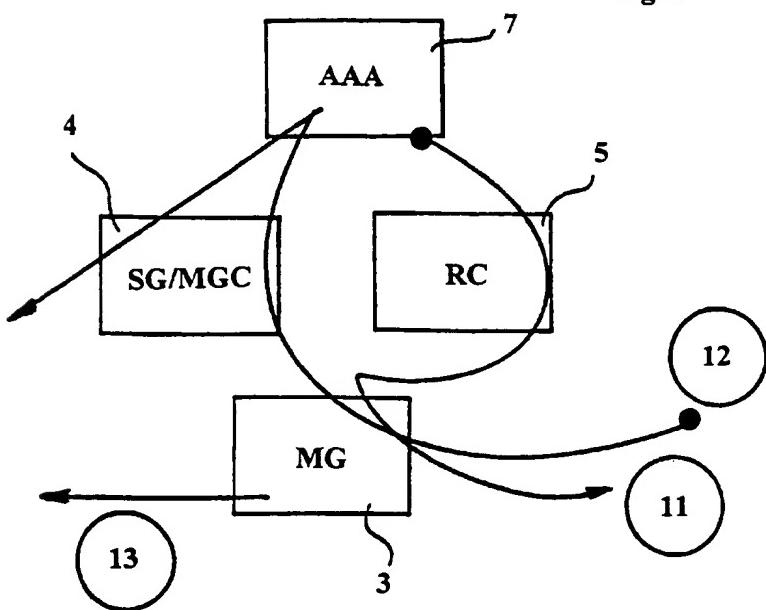


Fig. 2

SUBSTITUTE SHEET (Rule 26)

INTERNATIONAL SEARCH REPORT

International Application No
PCT, FI 00/00324

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04L12/56 H04L12/66 H04L12/46 H04Q11/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04L H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 546 452 A (ANDREWS G W ET AL) 13 August 1996 (1996-08-13) column 2, line 35 - column 3, line 10 column 5, line 20 - line 50 column 7, line 25 - line 41; figures 1-3	1-6,8-12
Y	---	7
X	EP 0 880 255 A (NORTHERN TELECOM LTD) 25 November 1998 (1998-11-25) column 4, line 3 - line 47 column 6, line 37 - line 57 column 8, line 45 - column 9, line 5 column 9, line 25 - line 43; figure 1 ---	1-6,8-11
	-/-	

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

* Special categories of cited documents :

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

Z document member of the same patent family

Date of the actual completion of the international search

Date of mailing of the international search report

25 July 2000

28.08.2000

Name and mailing address of the ISA

Authorized officer

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl
Fax: (+31-70) 340-3018

M. Eddin/EE

INTERNATIONAL SEARCH REPORT

International Application No
PC., FI 00/00324

C(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 0 474 427 A (AMERICAN TELEPHONE & TELEGRAPH CO) 11 March 1992 (1992-03-11) column 1, line 45 -column 2, line 13 column 4, line 1 - line 18 column 6, line 12 - line 40 ---	7
P,X	WO 99 62242 A (3COM CORP) 2 December 1999 (1999-12-02) page 2, line 1 - line 28 page 4, line 1 - line 24 page 5, line 10 - line 32 page 6, line 5 - line 29 page 7, line 12 - line 22; figures 3A-3C abstract ---	1-6,8-12
P,X	DATABASE WPI Section EI, Week 200015 Derwent Publications Ltd., London, GB; Class T01, AN 2000-167115 XP002901125 & JP 2000 022735 A (NIPPON DENKI ENG KK), 21 January 2000 (2000-01-21) abstract ---	12
P,X	HUIEMA CH ET AL: "An architecture for residential internet telephony service" IEEE INTERNET COMPUTING, vol. 33, May 1999 (1999-05), pages 73-82, XP002901126 the whole document ---	1-6,8-12
A	WO 97 28628 A (LABS OF ADVANCED TECHNOLOGIES INT CO) 7 August 1997 (1997-08-07) the whole document ---	1-6,8-12
A	ATASLAR ET AL: "Decentralized routing controller design for networks with more than two overlapping subnetworks" IEEE INTERNATIONAL CONF. ON SYSTEMS, MAN AND CYBERNETICS. INTELLIGENT SYSTEMS FOR THE 21ST CENTURY, vol. 4, 1995, pages 2960-2965, XP002901127 the whole document -----	7

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PL, FI 00/00324

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
US 5546452 A	13-08-1996	AU	696984 B	24-09-1998
		AU	5357396 A	18-09-1996
		CA	2188875 A	06-09-1996
		EP	0758508 A	19-02-1997
		US	5878130 A	02-03-1999
		WO	9627254 A	06-09-1996
		US	5848143 A	08-12-1998
EP 0880255 A	25-11-1998	CA	- 2205731 A	20-11-1998
EP 0474427 A	11-03-1992	US	5166931 A	24-11-1992
		AU	629486 B	01-10-1992
		AU	8340891 A	12-03-1992
		DE	69114090 D	30-11-1995
		DE	69114090 T	30-05-1996
		JP	4227150 A	17-08-1992
		JP	8031884 B	27-03-1996
WO 9962242 A	02-12-1999	AU	4223999 A	13-12-1999
JP 2000022735 A	21-01-2000	NONE		
WO 9728628 A	07-08-1997	AU	1851397 A	22-08-1997
		JP	2000504183 T	04-04-2000

**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- BLACK BORDERS**
- IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- FADED TEXT OR DRAWING**
- BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- SKEWED/SLANTED IMAGES**
- COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- GRAY SCALE DOCUMENTS**
- LINES OR MARKS ON ORIGINAL DOCUMENT**
- REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- OTHER:** _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.